

DOCUMENT RESUME

ED 447 315

CE 080 958

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TITLE Learning 2010 (London, England, September 2000).
INSTITUTION Further Education Development Agency, London (England).
ISBN ISBN-1-85338-595-6
PUB DATE 2000-00-00
NOTE 13p.; Based on expert seminars sponsored by FEDA and Ufi Ltd.
AVAILABLE FROM Further Education Development Agency, Citadel Place, Tinworth Street, London SE11 5EH, United Kingdom, Tel: 020 7840 5302/4, Fax: 020 7840 5401, E-mail: publications@feda.ac.uk, Web site: <http://www.feda.ac.uk>.
PUB TYPE Collected Works - Proceedings (021)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Access to Education; Adult Education; Communications; Computer Science; Computers; *Creativity; Developed Nations; Distance Education; Education Work Relationship; Educational Technology; *Educational Trends; Foreign Countries; *Futures (of Society); *Information Technology; Multimedia Materials; *Online Systems; Teacher Role; Teacher Student Relationship; *Technological Advancement; Vocational Education
IDENTIFIERS Great Britain

ABSTRACT

The "Learning 2010" project began with the question of the implications of technology for teaching and learning in Great Britain. Participants at expert seminars narrowed the focus to identify scenarios for how teaching and learning will develop in the next 10 years. Six key themes emerged. The theme of multimedia highlighted computers and the CD-ROMs, simulators, and virtual environments they brought in their wake; computer modeling that stimulates creative thought; and rapidly improving graphics capabilities, simulators, and virtual environments that could replace textbooks and provide a much richer learning experience. The theme of online learning addressed search engines capable of making requests on their own; the Internet as facilitating expression of ideas; and distance education. The theme of communication and access focused on the fear that without access for all, increasing reliance on the Internet may accelerate social exclusion and disadvantage. As for the theme of creativity and the learning process, computer technology was seen as presenting the possibility of learning with computers in a way that mimics the thought process and turns it into a journey of discovery. The theme of the role of the teacher addressed the changed teacher-student relationship. The theme of learning for work focused on course choice, newly created professions, and better linkage to employers and needs of the economy. (YLB)

Learning 2010

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Published by FEDA

Feedback should be sent to
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Tinworth Street, London SE11 5EF
Tel: 020 7840 5302/4 Fax: 020 7840 5401
FEDA on the Internet – www.feda.ac.uk

Registered with the Charity Commissioners

Editor: Jennifer Rhys
Designers: Dave Shaw and Joel Quartey

ISBN 1 85338 595 6

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Contents

Introduction	1
Learning 2010	
The pace of change	
Key themes	3
Multimedia	
Online learning	
Communications and access	
Creativity and the learning process	
The role of the teacher	
Learning for work	
Conclusion	8
References	9

Introduction

Learning 2010' started with a question: 'What will be the implications of technology for teaching and learning?' Straightaway, the idea generated tremendous interest from all sides. From educationalists; from industrialists; from teachers and trainers; and from policy-makers. This is an introduction to their perspectives on the big question.

Contributors

The expert seminars at which these ideas emerged were sponsored by FEDA and Ufi Ltd. They took place in September 2000 at Chatham House. Among the contributors were:

- Margaret Boden, Professor of Philosophy and Psychology at the University of Sussex School of Cognitive and Computing Sciences
- David Brown, Chairman, Motorola
- Peter Cochrane, Chief Technologist, BT
- Tim O'Shea, Master, Birkbeck College
- Jem Rashbass, Director, Cambridge University's Centre for Applied Research in Educational Technologies
- Michael Stevenson, Joint Director of Factual and Learning, BBC
- Anne Wright, Chief Executive, Ufi Ltd

Their presentations will be collected in a publication to be available later this year.

'Learning 2010' is a project that started with no plan. The partners were pretty clear what they wanted to do: think through answers to a simple question. The question was:

What will be the implications of technology for teaching and learning?

The idea generated tremendous interest from all sides: from educationalists; from industrialists; from teachers and trainers; and from policy-makers.

Perhaps this was because we were working during the term of a government that famously described education as 'the best economic policy' we have. Perhaps it was because we were at that point in history where, in the UK at least, connected computers look like becoming truly ubiquitous – seven million homes (28%) are now connected to the Internet, according to Oftel.¹

Perhaps it was because we had just seen a rash of failures of high-profile 'dot.com' businesses, and the time seemed right to probe what is substance – and what is hype – in the online world.

A group came together to take this thinking forward. All its members (see further information, page 11) have distinguished track records in education or technology (or both), and each agreed to offer their perspective.

It quickly became clear that the question was too big. On one level, there is a vision of a world that is digitally connected, with mature bio-technologies, nano-technologies and 'intelligent' machines. This could be the starting point for Arthur C. Clarke or Isaac Asimov!

At another, there are the practical questions of now:

- what to do about an underskilled UK workforce, and unacceptably poor levels of literacy and numeracy
- an Internet that can be creakingly slow; fears that it will create a 'digital divide'
- uncertainty about the commercial models for the online world

and much else in technology besides.

(This is, after all, the year in which the first iteration of the human genome project was completed.)

It was David Brown, the Chairman of Motorola, who nailed it. He suggested that the project look forward just ten years, and try to identify possible scenarios for how teaching and learning will develop.

The more we discussed it, the clearer the merits of this approach became. First, as Bill Gates is said to have remarked, people tend to over-estimate the impact of technological change over a three-year term, but under-estimate it over ten years. It is easy to miss the incremental changes that really make a difference, and that is as true for education as it is for anything else. Ten years is long enough.

Second, the technologies around in ten years will probably still be recognisable. We will not have entered the realm of science fiction, so ten years gives the opportunity to consider changes brought by new media and ICT, alongside those driven by likely policy initiatives, such as raising professional standards for teachers and trainers; regenerating communities; and focusing on learning in the workplace.

Finally, it is about the right length of time to be useful. To put it into perspective, some of the teachers qualifying today were in year 7 (aged about 12) ten years ago. This suggests that lessons learned today can help to shape the teaching profession for the year 2010.

'Learning 2010'

As we talked, David Brown made a key point about the future, and the companies that will operate there. He said that one way to describe Motorola's history is to say that the company actually created a new industry every twenty years or so. Not new products; not new brands; not new businesses. Entire new industries.

It seems clear that we need to look forward with a similar degree of ambition for 'Learning 2010'. Why? Because over ten years, pretty well everything will be negotiable. Economics, technology, skills needs and changes in society will shape the future of education and training – structures, institutions and ideologies that are not fit for purpose will simply be swept away.

I believe that 'future-gazing' in a structured way – asking searching questions and questioning opinions – is extremely valuable. Decisions taken now will make an impact one day; the alternative seems like an abdication of responsibility.

This brief essay will pick up some of the key themes to come through the 'Learning 2010' expert seminars. Forecasts, by their nature, tend to focus on measurements, targets or milestones. The following, for example, are all real forecasts for 2010:

- Brighton will have a climate closer to that of the South of France today²
- the UK is expected to have become a net importer of gas³
- the Jet Propulsion Laboratory in Pasadena, California could be launching a spacecraft with a huge sail, driven by the solar wind.⁴ Beginning a journey in 2010, this 'interstellar probe' would overtake Voyager 1 in 2018 – by which time Voyager 1 would have been going for 41 years.

The 'Learning 2010' project is not about forecasting in that sense. We wanted to look at a more dynamic interplay of technology, policy and leadership, somewhat in the spirit of futurologist Freeman Dyson:⁵

Economic forecasting makes predictions by extrapolating curves of growth from the past into the future. Science fiction makes a wild guess and leaves the judgement of its plausibility to the reader ... For the future beyond ten years ahead, science fiction is a more useful guide than forecasting.

All the same, making guesses about the future can be a highly dubious exercise. It is a cliché to say that technology will change things: the point is *how*.

The pace of change

The pace of change seems to be accelerating. By 2003, for example, it is estimated that there will be 1 billion mobile telephone users⁶ (double the total for 2000). This year, more than 500 million text messages will be sent from mobile phones in the UK each month,⁷ and 1 million mobile owners are under the age of 15.

In fact, the 'entry age' may be getting younger. Dr Kathleen Alfano, manager of Fisher-Price child research department and play laboratory in East Aurora, New York, as quoted in the *Times Educational Supplement*:⁸ 'When children move to another part of the play lab, they pick up their toy mobile phone and take it with them just like they've seen their mums and dads do.'

Perhaps it is no surprise that FEDA and a consortium of partner organisations have been commissioned by the European Union to assess the potential of the mobile phone as a device for Internet-based delivery of learning.

At the same time, most of the world's population have yet to make a phone call.

Although computers have become ubiquitous, they do not resemble HAL, the ship's computer in *2001: A Space Odyssey*. It is the distributed nature of ICT that has become its hallmark – and chips with everything!

Bosch, for example, are working on a major project to make their household appliances compatible with the Internet (for maintenance and diagnostic purposes), and expect to bring these 'to market by 2002'. Thus, although machine 'intelligence' still seems some way off, your kitchen equipment may soon communicate – and it seems likely that your car, as it passes each lamppost, will record your journey for road tax purposes.

Looking back, from 2010, it will undoubtedly be detail on the human scale that makes the difference.

So what are some of the themes we should be thinking about?

Key themes

Multimedia

Computers have brought CD-ROMs, simulators and virtual environments in their wake. Technologies originally developed for computer games are already making a huge impact, undreamed of when primitive arcade games like *Space Invaders* and *Asteroids* were the state of the art.

These applications offer instant feedback, and the Esperanto of the Windows GUI means that you can have a reasonable try at operating a new application, even if no-one has shown you how.

Peter Cochrane of BT is an enthusiast for computer modelling, to stimulate creative thought. You can build a model and try different conditions that would be impractical (or even inconceivable) in the real world.

An accountancy student, for example, can completely restructure a business on a spreadsheet on a PC, and watch the implications for cash-flow, profitability and so on. That just could not be done with a sheet of graph paper.

Rapidly improving graphics capabilities, simulators and virtual environments could replace textbooks with products that provide a much richer experience for the learner, and turn learning into a voyage of discovery.

Lord Puttnam talks of 'edutainment' to describe the blurring of boundaries between learning and fun. He makes the point that people brought up on computer games are used to moving quickly, and – being intuitively comfortable with multimedia formats – they demand input that is lively, engaging and attractive.

Perhaps, too, their familiarity with artificial 3-D environments, may lead to using spatial awareness to learn in new ways. It is a great opportunity to find multiple ways to explain concepts, so that those who relate best to visual models, for example, can learn as well as those who do better with verbalized theory.

However, will multimedia also constrain thinking, so that a particular kind of rationality derived from computing code and computer interfaces will be promoted at the expense of more abstract thought?

All the signs are that people brought up with the latest generation of video games will make discerning customers for the quality of the experience they are given. But those products have budgets rivalling Hollywood blockbusters, and so economics might become an issue for the diversity of material produced.

This analysis appeared recently in the *Economist*:⁹

Education, like information, is enjoying good times. Around the world the big customers, governments, are spending more. In markets such as America and Britain, politicians have reached a compromise on state education: the right agrees that more money needs to be spent, and the left accepts the need for standards and testing. The companies that provide the materials for educating children, and the means of measuring them, are set to do well.

But it is a business that, increasingly, demands size. In the American market, there are now four big educational publishers, Pearson, Houghton Mifflin, McGraw Hill and Harcourt Brace, down from a couple of dozen two decades ago. The costs of developing a reading or maths programme, which will involve hundreds of titles, are huge.

Online learning

The migration of the World Wide Web (WWW) beyond the PC to different devices, from digital TV to mobile phones, offers the possibility of transforming education and training.

How might this technology bring together worldwide sources for an A-level project, or engineering problem? The next generation of Boolean-powered search engines, like the popular 'Ask Jeeves', might become more 'intelligent'. In the future, they might not simply seek out keywords, but keep constantly alert for information from sources you have asked for. Perhaps they will be able to deal with e-mail addresses; they may make requests on your behalf and, in filtering the backwash of data that is the WWW, they may 'learn' to understand the type of subjects you are interested in. One day, they may even interpret your requests and ask for clarification. So, research is an obvious example, but it is just the start.

The defining application of the Internet is not the capacity to find obscure pieces of reference and information. It is the miasma of telecommunications and connectivity that makes up 'e-stuff'. Things selected and transmitted to you by friends, vendors, colleagues, and – potentially – teachers.

Central to that vision lies the Internet – and the ubiquitous dot.com.: online delivery, online materials, online support and online examinations.

In a sense, the Internet is nothing more than a way of connecting the world's PCs. Looked at in this way, most of the Web's infrastructure is in fact the telephone system. However, the protocols crafted by Tim Berners-Lee transform the system, in particular opening up new communication options. The bulletin board is much more powerful than the answerphone.

But while it is shaping up as the world's biggest market-place for just about anything, the Internet's architecture still carries the mark of the decentralised system that was designed to withstand nuclear conflagration. For one thing, no one owns it.

With the Internet as a public space, everyone can become their own publisher, and every voice can find an audience. The technology enables a thousand (a billion!) flowers to bloom. Perhaps Andy Warhol will turn out to be right, and we will all get fifteen minutes of fame in cyberspace.

The downside is, of course, that like any common good, it can be abused. The bandwidth-hungry advertising graphics that come with most commercial sites and slow the whole process are a good example.

Also, the Internet does not work reliably enough now, and yet we haven't really started. Should we be worried? Will the WWW make it through?

Governments must eventually decide, but the signs are positive. The UK government is committed to an online strategy, based explicitly on the Internet, so that investment and control should be available to deliver it as a reliable piece of infrastructure.

Michael Stevenson, the Joint Director of Factual and Learning at the BBC, heads up a massive investment into education using the WWW, and Ufi Limited, the company responsible for delivering a UK university for industry is also committed to the web as a delivery mechanism.

These initiatives will give the correspondence course a whole new dimension. Distance learning becomes less a compromised add on, borne of necessity, than an upbeat new format that can be tailored to the individual. It can use the fact that you are sitting in front of a screen of known dimensions to format a wide range of video, sound, pictures, text, and questions to individualise your experience. That staple of learning, the submitted piece of work, can be accepted, assessed and returned more easily.

This is the essence of the vision, as put by Anne Wright, Chief Executive of Ufi Ltd:

The e-learning revolution is primarily a revolution for learners. Self-managed e-learning enables people to get the skills they need when they need, and to learn when, where and how they want to in ways that fit their lives and work. The personal learning home page, Learning 'favourites' and personal learning log turn 'distance' learning into immediate, individualised learning – learning 'up close and personal'.

Communication – and access

So the communication element of information and communications technology (ICT) turns out to be the great opportunity (as well as the great democratiser) of the Internet.

But an important theme that came back again and again during the 'Learning 2010' project was the equal importance of the infrastructure – and the fear that without access for all, increasing reliance on the Internet may accelerate social exclusion and disadvantage.

Even with the migration of the WWW to an array of digital devices, from televisions to mobile phones, there remain practical issues that may be barriers. For example, if there is only one digital television in the household, will it be available for learning, or will it be commandeered for TV or video games?

Will some people simply represent 'unprofitable' markets for online advertising? Or commercial learning products?

Above all, will low expectations and a culture that is not geared to learning mean that people will not take up the opportunities offered by ICT?

Michael Stevenson is very clear in his vision; underlining the importance of an inclusive system that prioritises access for everyone. He looks forward to a future in which the BBC can provide real choice in the ways in which it delivers learning.

Despite increased commercialisation, and the danger of creating a 'digital divide', the WWW can empower individuals. Disability campaigns, for example, have long used the Internet for communication and briefing between individuals and local groups. It represents a very effective medium where travel is difficult or expensive, or where activities must be co-ordinated over long distances. It had a particularly quick take-up in the United States where local telephone calls are usually unmetered.

Plus, as public officials and politicians go online, it can be a quick and effective lobbying tactic.

A different example of spontaneous co-operation concerns a programme called Broderbund 'Family Tree Maker', which began life as a package for amateur researchers plotting their family history. So many hobbyists have used it, that there is now a website putting many of the family trees together – and this has yielded contributions that connect many of the families of Europe. (If you have a European surname, you can find it at www.familytreemaker.com.)

Just think what this sort of worldwide collaboration might mean for learning. Where once you had to visit world-class experts in a subject to chew over ideas, the e-mail, the bulletin board, the teleconference and the on-line tutorial may radically transform the learner's access to the specialist. And lateral thinking might result in all sorts of new ways to explore and discover – and learn.

So what opportunities do the new technologies present for learning to be creative?

Creativity and the learning process

Maggie Boden, Professor of Philosophy and Psychology at the University of Sussex School of Cognitive and Computing Sciences, offers a framework to define 'creativity' that is particularly applicable to the learning process. It focuses on the different ways in which ideas are combined and boundaries changed – the different ways in which things can be new.

For generations it has been the role of teachers and trainers to bring students to the oracle. Most will learn nothing that has not been learned before. But a light will have switched on; they will have gained an insight that is new to them.

Computer technology, however, presents the possibility of learning with computers in a way that mimics the thought process, and may turn the process into more of a journey of discovery than following a well-trodden path – or a fixed course.

Jem Rashbass, Director of Cambridge University's Centre for Applied Research in Educational Technologies, articulates this question in a particularly graphic way – asking whether hypertext and html links, on the global scale of the WWW, might present the opportunity to mimic human thought. If so, is there the possibility that the Internet could suddenly 'wake up'?

Jem's vision of how IT can change the experience of the learner is a *tour de force* but he is concerned not to hype. In particular he condemns shallow electronic textbooks and threadbare, low-budget production values – reinforcing the point that a generation brought up on video games will not put up with them. And he speaks with real passion about the potential for these technologies to deliver totally new pedagogical experiences.

One thing is clear. However far into the future you look education will always be about far more than simply instructing people how to use tools (or computer applications). Tim O'Shea, Master of Birkbeck College, is cautious about breaking learning too much into 'bite-size chunks', because he fears that losing the context diminishes both the experience and the depth of understanding.

In fact, there was clear consensus that undiluted on-line teaching or training is more than a heartbeat away.

The role of the teacher

But what will the classrooms and lecture halls of the future be like? And what about teachers and trainers themselves?

At the first 'Learning 2010' seminar, Chris Hughes, FEDA's Chief Executive, asked participants to agree (or not) with three statements about education and training in ten years' time:

- the subjects and curricula people learn will be radically different
- the teaching profession will be unrecognisable
- the infrastructure – both in institutions and the move to ICT – will be transformed.

There was widespread agreement with both the first and the third statements, but notable disagreement with the second. In fact, there was less clarity or consensus on the role of the teacher as the project progressed.

One of the views consistently shared among those looking at the future of IT and its application to education and training is that it will change profoundly the relationship between teacher and student. Given easy access to the latest reference material and, possibly, contact with subject specialists, the role of the teacher may evolve. Less the fount of all wisdom; more the wise guide. What might this mean?

One model is of the teacher as consultant; not so much imparting knowledge as supporting the creative process. A collaborative approach between learners and their teachers might help to focus on the outcomes of learning. For example, different examination regimes may be compared with a keener eye. What are the benefits of this qualification compared with that? More appropriate choices about what to study might persuade learners to stay longer in the system.

Students more engaged in their course may want to negotiate the content. How might this stretch funding systems based upon qualifications as outcomes? How might it stretch the nature of the qualifications themselves?

On the ground, colleges and universities are already creating new learning professions. The librarian has become a 'consultant' supporting the learner in using the technology, and, increasingly, in doing their own research.

Learning for work

No doubt about it, the advent of IT is already heralding a change in the attitude of learners. This is perhaps most obvious in computer-based courses, where students are not content with a vague explanation of what they will learn, because they are acutely aware of the uses and relevance of the applications they will be working with. And whether it is version 2.4 or 3.0!

Education and training post-16 form a 'mixed economy' with both public money and investment by employers. Government policy is clearly geared to a framework that makes the most of these sources by engaging in a common project to create a world-class workforce. In this world, a mindset that sees individual students as funding units on legs will no longer be tolerable.

So it is about more than the courses themselves. How they are integrated into the wider employment market becomes a definition of quality. Consider the following dialogue:

*'I'd like to do a computer course ...
what do I need to get a job as a programmer?'*
'We've got this City and Guilds course.'
'Yes, but what will it qualify me for?'
'Hmmm ... we've got this City and Guilds Course.'

Not good enough. There must be better links both to employers and to the needs of the economy (not necessarily the same thing) so that the qualifications carry credibility where it matters. And there must be better systems to signpost learners so that they can make the best choices – especially those who have traditionally dropped out of learning.

Does this mean we are looking at a more vocational curriculum? Consider this example.

There are now more than 3,000,000,000 web pages, the combined effort of millions worldwide. They have been produced for a host of different reasons but it is clear that commercial sites represent an increasing proportion of them, as businesses of all sizes go online.

This has created an entirely new profession – Web authoring – very much the part of the knowledge economy. For people operating in new industries like this, success depends upon constantly updating skills and know-how, because as technologies rapidly mature then become obsolete, new packages and formats continually emerge.

Macromedia Dreamweaver is a current example. It is a computer programme that lays out and builds web pages using a 'point and click' front-end, then coding them in 'html' – the programming language of the World Wide Web.

People learning to use Dreamweaver are following a craft tradition stretching back to the industrial revolution. Before the advent of the Internet as a communication medium, they might have been film-planners, and before that typesetters.

It seems unlikely that courses in applications such as Macromedia Dreamweaver will be (or even could be) planned on an old-style Manpower Services Commission model. We live in a world that is more entrepreneurial now.

But are new 'knowledge economy' skills different from more traditional crafts – plumbing, construction and the like? If they are, perhaps this stems from the changing nature of the industries that use them, the motivations of those who wish to learn them and the potential for ICT to deliver the learning in new and different ways.

What questions does this raise for teaching and training?

For instance, a student might wish to learn to use Macromedia Dreamweaver for several different reasons. The most common might be to get a job as a web author but, equally, it might be to create the electronic equivalent of a fanzine. For the marketing of courses, the way that these two markets are differentiated is important. Building a strategy to recruit students requires a clear target audience and, of course, the right key message.

So, what course would you be selling? And, specifically, who is accrediting it?

One textbook definition of a 'brand' is 'a guarantee of quality'. So whose imprimatur underwrites a course like Dreamweaver? Is it City and Guilds – as trusted by generations of employers? The Macromedia Corporation – 'What the web can be'TM? Is it Ambridge College – 'Serving our community'? Might it, in the future, be 'learndirect' – 'Fits learning into life'[®]?

There is a crucial link to employers here. If they do not respect these qualifications, a highly vocational course like this is doomed. So how are they engaged to help shape the curriculum?

Above all, what is the purpose of the learning? Is it self-fulfillment, an end in itself? Is it the award of a qualification? Or is it success in landing (and keeping) a job?

Conclusion

Schools, colleges and universities: these institutions have outlived governments and funding regimes and will probably still be here when the Learning and Skills Council has long gone. Nevertheless, it seems clear that they will change.

FEDA and Ufi Ltd have launched the 'Learning 2010' project to examine some scenarios for the future, working with leading thinkers from industry, education and the media.

Some of the ideas and themes that emerged have been outlined here.

Welcome to the digital age.

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